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H4B
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(54) Optical communication terminal

(57) In an optical transmission system automatic (or semi-automatic) fault location is effected by a loop-back component (10) connected to a terminal's transmitting equipment (3) via a first optical coupler (4) and to an output to which a receive power meter (9) can be connected. A launch power meter (8) can also be connected to the loop-back component (5). The component (5) includes switching means (10) which connects the first coupler to the launch power meter or to a second coupler to measure an estimate of power level received from a remote transmitter. In normal operation the receive power meter (9) if connected to a second coupler 7, measures a proportion of the power from a remote transmitter. If a fault occurs readings are taken with switching means in different settings and the results of these readings enable the fault to be located.

The switching means can be an optical switch, or an optical coupler whose output to the second coupler goes via an on/off switch or an electrically adjustable attenuator.

Fig.1.

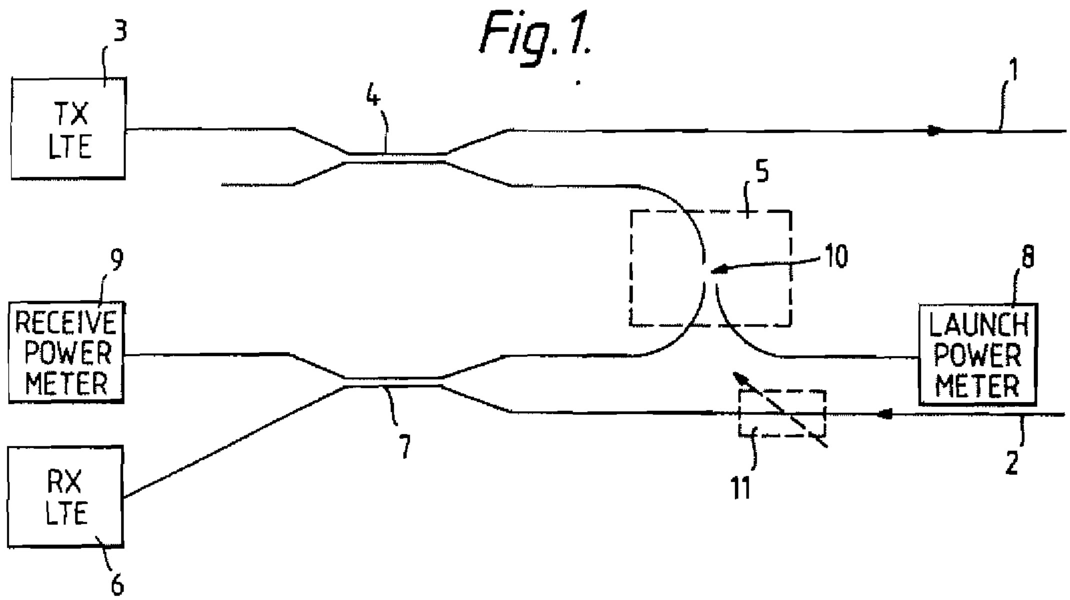

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Fig.1.

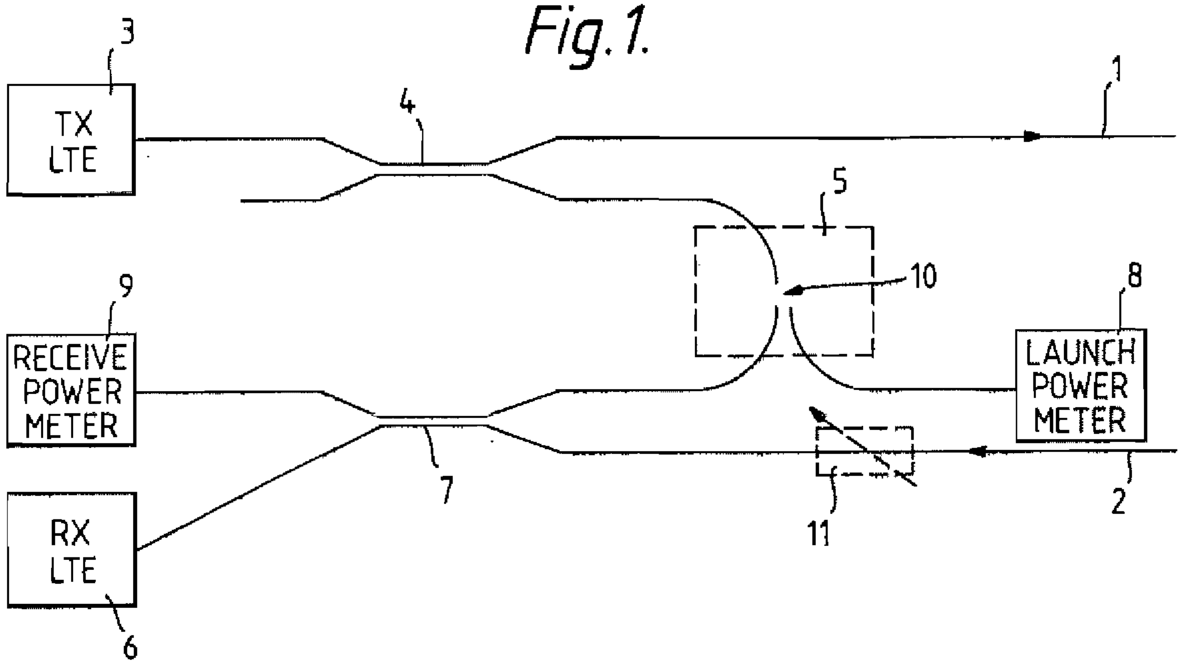


Fig.2.

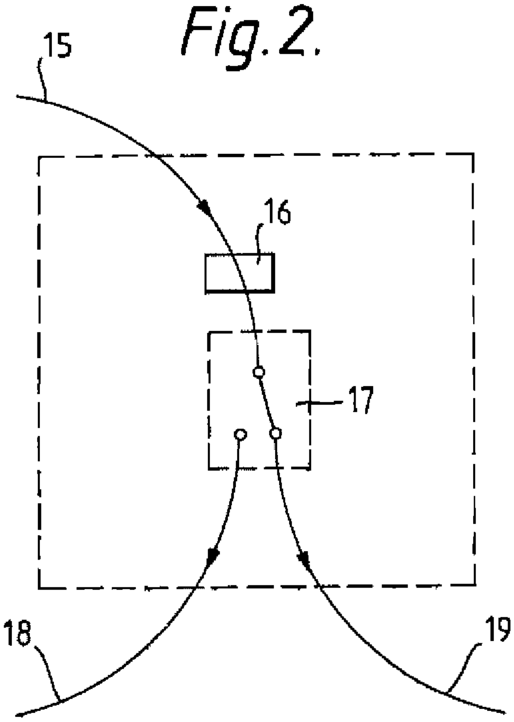
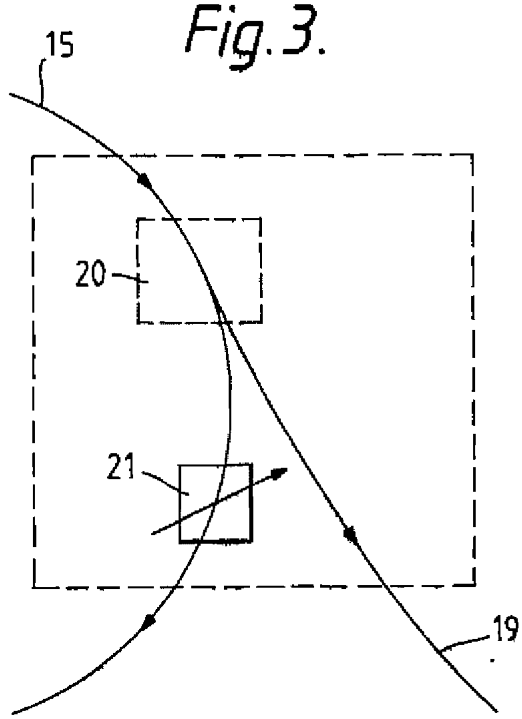


Fig.3.



SPECIFICATION

Optical Communication Terminal

The present invention relates to a terminal arrangement for use in an optical fibre transmission system, and especially to a loop-back test method in such a terminal arrangement.

Optical fibre transmission systems require fault location techniques to enable the automatic isolation of a failed part of the system. To enable a fault in a transmitter, a receiver or a cable to be identified, an optical loop-back can be used. This can be achieved by switching the output of a transmitter to the input of a receiver in the same terminal. However, this requires a low insertion loss, high reliability, single mode switch, which is expensive.

An object of the invention is to provide a terminal arrangement in an optical fibre transmission system with a more economical loop-back arrangement.

According to the invention there is provided a terminal arrangement for an optical fibre transmission system which is connected when in use to an outgoing optical fibre and an incoming optical fibre, which arrangement includes a loop-back component coupled to the outgoing fibre via a first low tap ratio optical coupler and to the incoming optical fibre via a second low tap ratio optical coupler, and optical switching means included in the loop-back component, wherein in one setting of the switching means the terminal arrangement is coupled via the first coupler and the switching means and the second coupler to a first output at which the outgoing power level as indicated by the proportion of the power tapped off by the first coupler, wherein in a second setting of the switching means the first and second couplers are effectively disconnected so that the power from a remote terminal arrangement can be measured while that power is being received by the terminal arrangement.

Embodiments of the invention will now be described with reference to the accompanying drawing, in which Fig. 1 is a schematic diagram of a terminal arrangement for an optical fibre transmission system, embodying the invention, and Figs. 2 and 3 show schematically two forms of loop-back components of use in the system of Fig. 1.

In Fig. 1, the terminal is connected to the outgoing and incoming single mode optical fibres 1 and 2 of a transmission cable which may be connected to the highway of a local area network, or to a line circuit at a telephone exchange, or to a trunk transmission system. The transmitting line terminating equipment 3 is connected via a low tap ratio optical coupler 4 to the outgoing fibre 1 and to a loop-back component 5. The receiving line terminating equipment 6 is connected so as to receive incoming light signals from the fibre 2 via another low tap ratio coupler 7. There is also a launch power meter 8 shown as connected via another fibre to the component 5. In addition, a receive power meter 9 can be connected via another fibre to the coupler 7. The component 5 contains switching means 10 and two forms which this can take are described below with respect to Figs. 2 and 3.

In one setting of the switching means 10, a proportion of the power from the equipment 3 passes via the coupler 4 and the switching means 10 to the meter 8, to give a measure of the level of power from the equipment 3. In a different setting the power from the coupler 4, which is a proportion of the power emitted from the block 3, is routed to the meter 9. This enables the operation of the switching means 10 and of the meter 9 to be checked. In addition, see below, the power level which reaches the meter 9 simulates the level of power receivable from a remote transmitter. When the switching means 10 is in its first condition, the receive power meter 9 receives a proportion of the incoming power from the fibre 2 via the coupler 7. When faults occur it will be seen that the results of the various meter readings for the different settings of the switching means 10 will enable the fault to be located. The operation of the switching means 10 and the assessment of the measurements can be effected under the control of a processor forming part of the terminal which includes the equipments 3 and 6.

When the switching means 10 is set to allow power from the block 3 to reach the meter 9, the level of this power which reaches the meter 9 is the expected level for power from a distant transmitter. The switching means 10 also serves to ensure that the signal from the local transmitter via the tap 4 is unable to interfere with the receive signal from a remote transmitter when the receiver is carrying traffic.

We now turn to Fig. 2, which shows one form which the switching means 10 can take. In this arrangement, the fibre 15, which is a single mode fibre, from the coupler 4 (Fig. 1) is connected via a fixed attenuator 16 to an optical switch 17. In one setting this connects the fibre 15 to another fibre 18, also a single mode fibre, which goes to the coupler 7 (Fig. 1). In its other setting the switch 17 connects the fibre 15 via another single mode fibre 19 (or a multimode fibre) to the launch power meter 8 (Fig. 1). This switch can also have a third or off, setting in which it does not connect to either fibre 18 or 19.

In Fig. 3 we see another form which the switching means 10 (Fig. 1) can take. Here the fibre 15 from the coupler 4 (Fig. 1) goes to a coupler 20 which has two outputs. This coupler can be all single-mode, or it may include a single mode output via the attenuator 21 and a multimode output via the fibre 19. One goes via an electrically adjustable single mode attenuator 21, which can be an attenuator of the type described in our Application No. 8611178 (J. S. Leach 15). The other output of the coupler 20 goes to the fibre 19, which could be a multimode fibra as just indicated. As an alternative, the attenuator 21 can be replaced by a simple on/off switch.

It will be seen that in the arrangement of Fig. 3, the launch power meter is always in circuit, and that, like the arrangement of Fig. 2, the receive power meter is always in circuit when light is being received over the fibre 2 (Fig. 1). As indicated above, the equipment 6 is a receiver. The receive power meter 9 is of little importance when the system is

looped back via the switching means 10. Its function is for testing the receive power level for the signal from the remote transmitter (i.e. far end of fibre 2) when in service. Thus the receive power meter is used to test operations via loop-back, in which case, as set out above, the power which it receives from the equipment 3 simulates the expected power level from a remote transmitter. In its other application, it tests the actual level of the received power during normal operation.

An optical variable attenuator, 11, Fig. 1, an on/off switch, may be provided to reduce the level of signal from a remote trensmitter while a loop-back test is in progress.

The provision of launch power and receive power meters is optional, and allows test points to be available for non-intrusive measurement of launch and receive power levels. It may also be possible to check for the location of cable breaks using reflectometers connected to these test points.

The variable attenuator shown, optionally, at 11, Fig. 1, is normally set to a low loss condition, or preset to an attenuation level which gives a suitable power level for the signal from the remote transmitter. However, it is switched to a higher attenuation state to reduce the signal from the remote transmitter when loop back of the local transmitter is needed for a fault location test. This avoids interference from the remote transmitter during the loop back test.

In the second setting the transmitted signal is fed back to the local receiver to test the integrity of that signal. The receive power meter 9 is normally used as a test of the receive power level from the distant transmitter when the loop back component is in its first condition.

CLAIMS

1. A terminal arrangement for an optical fibre transmission system which is connected when in use to an outgoing optical fibre and an incoming optical fibre, which arrangement includes a loop-back component coupled to the outgoing fibre via a first low tap ratio optical coupler and to the incoming optical fibre via a second low tap ratio optical coupler, and optical switching means included in the loop-back component, wherein in one setting of the switching means the terminal arrangement is coupled via the first coupler and the switching means and the second coupler to a first output at which the outgoing power level as indicated by the proportion of the power tapped off by the first coupler, wherein in a second setting of the switching means the first and second couplers are effectively disconnected so that the power from a remote terminal arrangement can be measured while that power is being received by the terminal arrangement.

2. A terminal arrangement as cleimed in claim 1, wherein the switching means is an optical switch.

3. A terminal arrangement as claimed in claim 1 or 2, wherein the connection from the first coupler to the optical switch is made via a fixed attenuator.

4. A terminal arrangement as claimed in claim 1, wherein the switching means includes an optical coupler via which the first coupler can be connected to the second coupler, and wherein the connection to the second coupler is via an on/off switch which when on effectively connects the coupler in the loop-back component to the second coupler.

5. A terminal arrangement as claimed in claim 1, wherein the switching means includes an optical coupler via which the first coupler is connected to the second coupler, and wherein the connection to the second coupler is via an electrically-adjustable optical attenuator.

6. A terminal arrangement for an optical fibre transmission system, substantially as described with reference to Figs. 1 and 2, or to Figs. 1 and 3 of the accompanying drawings.

7. A terminal arrangement for an optical fibre transmission system, which is connected when in use to an outgoing optical fibre and an incoming optical fibre, which arrangement includes a loop-back component coupled to the outgoing optical fibre via a first optical coupler and to the incoming optical fibre via a second optical coupler, and optical switching means included in the loop-back component, wherein in one condition of the switching means the outgoing fibre from the terminal arrangement is coupled via the first coupler and the switching means and the second coupler to a first output at which the outgoing power level as indicated by the proportion of the power tapped off by the first coupler can be measured, and wherein in a second condition of the switching means the first and the second couplers are effectively disconnected so that the power received via the incoming optical fibre from a remote terminal arrangement can be measured while that power is being received.

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